Corrective Measures Study Work Plan
The Boeing Company Tract 1
Hazelwood, Missouri

Prepared for:

The Boeing Company
Environment, Health and Safety
Integrated Defense Systems
P.O. Box 516, MC S111-2491
St. Louis, MO 63166-0516

Prepared by:

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November 2009

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The Boeing Company
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December 17, 2009
107E-6367-JWH

Ms. Christine Kump-Mitchell
Environmental Engineer
Permits Section
Missouri Department of Natural Resources
7545 S. Lindbergh, Suite 210
St. Louis, MO 63126

BOEING

RE: Corrective Measures Study (CMS) Work Plan
Boeing Tract 1, Hazelwood, Missouri
EPA ID# MOD000818963

Dear Ms. Kump-Mitchell:

Thank you for your letter dated October 27, 2009, and approval to extend the submittal date of our CMS Work Plan. We are submitting three copies of the CMS Work Plan (attached) in accordance with your August 24, 2009, letter approving the September 2004 risk assessment report and two addendums prepared by RAM Group on behalf of The Boeing Company.

We believe this work plan meets the:

- Requirements in Section VII., *CMS Work Plan of the Missouri Hazardous Waste Management Facility Part I Permit MOD000878963, dated March 5, 1997, and*
- Guidance contained in the USEPA document *RCRA Corrective Action Plan (Final), May 1994, OSWER Directive 9902.3-2A.*

We will contact you to set up a conference call or meeting to discuss the work plan and to develop a mutually acceptable CMS outline and schedule.

We look forward to your approval of the work plan. Please contact me if you need additional information.

Sincerely,

Joe Haake

Joseph W. Haake, Group Manager
Environmental and Hazardous Materials Services
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(314) 777-9181

cc: Stephanie Doolan, USEPA (2 copies)
Atul Salhotra, RAM Group

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This document presents a brief overview of the approved *RCRA Facility Investigation Report for McDonnell Douglas, Hazelwood, Missouri* (MACTEC, December 2004) (RFI) and *Risk-Based Corrective Action Report, Boeing Tract 1, St. Louis, Missouri* (RAM, September 2004) and addendums (RAM, June 2009 and July 2009) (RA); and the U.S. Environmental Protection Agency Final Risk Assessment, Boeing Tract 1 Facility, St. Louis, Missouri, (Tetra Tech March 2008) for the Boeing Tract 1, Hazelwood, Missouri (site). The interim soil remediation activities conducted at the site subsequent to the RFI and RA and the ground water monitoring are also presented. Based on these reports, the document presents a focused CMS work plan for the areas where the RA exceeds the acceptable level.

As part of the CMS, the following activities will be conducted:

1. The risk assessment indicated exceedences of risk to receptors due to indoor and outdoor inhalation. However, the risk was estimated based on groundwater concentrations, a method that overestimate's the risk. Hence, soil vapor samples will be collected to more accurately, but still conservatively, evaluate risk due to indoor and outdoor inhalation.

2. Risk will be recalculated using post remediation data for areas where (i) interim measures have been conducted, and (ii) risk exceeded based on pre-remediation data.

3. A monitoring plan will be developed to evaluate/demonstrate plume stability.

4. If the risks remain unacceptable based on items 1 and 2 above, remedial measures will be selected based on regulatory approved criteria as discussed in the body of this document.

5. The proposed land use restrictions will be finalized as a part of the CMS.

1.1 BACKGROUND AND OBJECTIVE OF STUDY

The Missouri Department of Natural Resources (MDNR) and The United States Environmental Protection Agency (USEPA) approved the *Risk-Based Corrective Action Report, Boeing Tract 1* (RAM, September 2004) and addendums (RAM, June 2009 and July 2009) in a letter dated August 24, 2009. In that letter the MDNR and USEPA (agencies) requested that The Boeing Company (Boeing) progress to the Corrective Action process and prepare a Corrective Measures Study (CMS) Work Plan.

Previous to the approval of the risk assessments, on December 22, 2004 MDNR approved the *Resource Conservation and Recovery Act Facility Investigation (RFI) Report* (MACTEC, December 2004). Subsequent to the approval of the RFI, in 2005 interim actions involving excavation and off-site disposal of soil were conducted.

This document presents the Work Plan for the CMS prepared in accordance with Section VII., *CMS Work Plan of the Missouri Hazardous Waste Management Facility Part I Permit* and is consistent with the guidance contained in the USEPA document *RCRA Corrective Action Plan (Final), May 1994, OSWER Directive 9902.3-2A.*

The objective of the CMS Work Plan is to present the procedures to be used during the CMS to identify, evaluate, and propose the necessary remedial alternatives to address the specific areas that present an unacceptable risk. Areas where risk is acceptable will not be evaluated further. In addition, the site-wide groundwater impacts will be evaluated to ensure the plume is stable or decreasing.

1.2 CHRONOLOGY OF RELEVANT ACTIVITIES

There have been numerous investigations at the facility including a RFA, UST removals/investigations, and environmental assessments and investigations. These previous assessments/investigations culminated in the approved RFI.

1.2.1 Resource Conservation and Recovery Act (RCRA) Facility Investigation Report (RFI)

The RFI was prepared by MACTEC Engineering and Consulting, Inc. dated December 2004. The objectives of the RFI were to:

- Determine the nature and extent of impact to the study areas,
- Determine the physical properties and characteristics of the affected media, and
- Obtain the necessary data to support the risk assessment and CMS.

The RFI divided the facility into 18 study areas based on the results of the previous assessments, investigations, and interim measures. The geology and hydrogeology are characterized in the RFI. Aquifer testing was performed and soil samples were collected for analysis of geotechnical parameters. Several soil borings were advanced and temporary piezometers, permanent piezometers, and monitoring wells were installed (MACTEC Table 3-1, December 2004 presents a listing of the monitoring wells). Soil and groundwater samples were collected, field parameters measured, and samples analyzed in the laboratory. Samples were analyzed using approved laboratory methods for one or more of the following constituents:

- Volatile organic compounds (VOCs),
- Polynuclear Aromatic Hydrocarbons (PAHs),
- Polychlorinated byphenols (PCBs),
- Total and dissolved metals, and
- TPHs.

The primary conclusion of the RFI was that (i) the impacts to soil and groundwater have been adequately identified and delineated, and (ii) the impacts are confined to the facility and do not extend offsite or cross from the North Tract to the South Tract or vice versa.

The data collected in the RFI were used in the subsequent risk assessments.

1.2.2 Risk Assessments

Two risk assessments were performed:

- Risk-Based Corrective Action Report, Boeing Tract 1, St. Louis, Missouri, dated September 2004, and addendums dated June 2, 2009 and July 24, 2009, prepared by Risk Assessment & Management Group, Inc. (RAM).

- Final Risk Assessment, Boeing Tract 1 Facility, St. Louis, Missouri, dated March 2008, was prepared by Tetra Tech EM, Inc. (TetraTech) for the USEPA.

1.2.2.1 RAM Risk Assessment

The RAM risk assessment divided the facility into 23 Areas and Sub-areas, each characterized by similarities in factors that affect human health under reasonable current and future land use conditions (Table 1-1 and Figure 1-1). The soil and groundwater data set compiled for use in the risk assessment came from the RFI. The receptors, pathways, and complete routes of exposure for current and future land use were identified for each Area/Sub-area.

The large number of constituents analyzed in soil and groundwater were screened to identify the constituents of concern (COCs) for which quantitative risk were evaluated. Constituents that were non-detect in a media were eliminated from that media. The list of

COCs for each Area/Sub-area based on all media and all receptors is presented in Table 1-2.

The risk evaluation consisted of calculating risk for each receptor in each Area/Sub-area using the Missouri Risk-Based Corrective Action (MRBCA) process. The cumulative risk for each receptor in each Area/Sub-area is summarized on Table 1-3. Further, the risk evaluation identified the potential impacts to Cold Water Creek and concluded the absence of any ecological risks.

The cumulative risk exceeded the regulatory acceptable level for carcinogens and /or for non-carcinogens in Sub-areas 2A, 2B, 3A, 3C, 3E, 3G, 6B, 6C, and 8B (Figure 1-1).

1.2.2.2 Tetra Tech Risk Assessment

Before accepting the results of the RAM risk assessment, the USEPA asked Tetra Tech to perform a risk assessment of selected areas using the USEPA Risk Assessment Guidance for Superfund (RAGS) protocols. The Tetra Tech risk assessment focused on Sub-areas 2C, 3F, 3H, and 6B.

Unacceptable exposures were identified for the construction worker and outdoor worker due to groundwater impacts in Sub-areas 2C, 3H, and 6B. Tetra Tech also indicated that arsenic was unacceptable to the outdoor worker as a non-carcinogenic hazard in Subarea 6B soil; however, their calculations did not indicate an exceedence.

1.2.3 Additional Investigations and Interim Actions

Since the completion of the RFI and risk assessment, interim remedial measures and groundwater monitoring have been conducted as discussed below.

1.2.3.1 Interim Action Remedial Excavation Completion Report, Boeing Tract 1 (MACTEC, May 2006)

Based on the RAM Group risk assessment, there was an unacceptable risk at four locations based on TPH-Diesel Range Organics (DRO) with impact limited to single soil borings (Risk Areas 6B, 3A, 3E, and 8B). These exceedences were based on the future exposure pathway of volatilization from groundwater to indoor air. Additionally, an unacceptable risk for benzo(a)anthracene was present in Risk Area 6B based on the future exposure pathway of direct contact with groundwater by a construction worker.

As an interim action, impacted soil was excavated at each of these areas and disposed off-site. The objective was to remove impacted soil that could be a source for shallow groundwater impacts. Table 1-4 shows the soil samples used in previous risk calculations that were collected in soil excavated as part of the interim action and hence removed. As a part of developing this CMS Work Plan, RAM Group has recalculated the representative soil concentrations for these Sub-areas (6B, 3A, 3E, and 8B) not including the soil concentrations for samples removed during the excavations. As expected, the

representative soil concentrations are lower. Since the pre-excavation soils did not present an unacceptable risk, there is no need to re-calculate risk for the soils.

The following piezometers were installed in each interim action area and groundwater samples were collected and analyzed once prior to and twice after completing the interim action excavations.

- Sub-area 6B – RC13, RC14, and RC15
- Sub-area 8B – B220N4, B220N5, and B220N6
- Sub-area 3A – B42N6, B42N7, and B42N8
- Sub-area 3E – B2E3, B2E4, and B2E5

COCs that exceeded risk (benzo(a)anthracene at Sub-area 6B and TPH-DRO at all four Sub-areas) were not detected in any of the groundwater samples analyzed from the four Sub-areas during the two post excavation sampling events; therefore, additional groundwater sampling was not recommended.

1.2.3.2 Interim Measure Completion Report, Solid Waste Management Unit 17 (MACTEC, June 2006)

Based on the RAM risk assessment, there was an unacceptable risk for tetrachloroethylene (PCE) at SWMU 17 based on dermal contact with groundwater by a future construction worker.

As an interim action, impacted soil was excavated from SWMU 17 and disposed off-site. The objective was to remove impacted soil that could be a source for shallow groundwater impacts. The excavation was dewatered during excavation and the water stored in temporary tanks onsite until characterized for disposal. Based on the characterization results, the water was disposed at the Boeing Industrial Waste Water Treatment Plant (IWWTP). About 8,000 lbs of Hydrogen Release Compound (HRC) was added to the floor of the excavation. Groundwater samples were collected and analyzed from nearby piezometers and monitoring wells prior to the interim action excavation. Three piezometers and a monitoring well (TP-1, TP-2, B51I1, and MW-7S) were removed during the excavation and were not replaced.

A 4-inch diameter stainless steel well screen was placed in the southeast corner of the excavation to a depth of 10 ft to act as a backfill observation well (SWMU17-OB-1). No post excavation groundwater sampling was performed as part of the interim action measure.

Table 1-4 shows the soil samples used in previous risk calculations that were removed by this interim action. RAM Group has recalculated the representative soil concentrations for this Sub-area (2B) not including the previous soil concentrations for samples that have been removed during the excavations. As expected, the representative soil concentrations are lower. Since the pre-excavation soils did not present an unacceptable risk, there is no need to re-calculate risk for the soils.

1.2.3.3 RAM Group Groundwater Sampling – November 2008 with reports in 1/09, 5/09, and 6/09

RAM Group performed a reconnaissance of available monitoring wells at the Boeing facility on July 29-30, 2008 and performed low-flow purging and groundwater sampling on November 17-21, 2008. The following reports and memoranda were submitted to the MDNR based on the results of this sampling event:

- *November 2008 Groundwater Sampling Data Compilation Report, Boeing Tract 1, Hazelwood, Missouri,* dated January 16, 2009, prepared by RAM.

  This report is an inventory of the data collected during the field activities to locate accessible wells, development of the wells, purging and sampling, and the laboratory analysis of data from 57 monitoring wells.

- *Changes in Groundwater Concentrations per November/December 2008 Sampling Event, Boeing Tract 1, St. Louis, Missouri*, Memorandum date May 8, 2009, prepared by RAM.

  This memo compared the November 2008 groundwater data for each well sampled to the previous sampling event data for that well. There was no clear trend from the previous sampling events. However, for wells that had detectable concentrations during both events, most but not all concentrations decreased. Trace LNAPL levels were noted in 7 of the 57 wells gauged and only one well showed an increase in thickness (MW-10S from 0.01 to 0.05 ft. Free product was observed in only three Sub-areas (1, 2B, and 2C).

- *Groundwater Flow Gradient – Shallow and Deep Groundwater Zones, November 17-19, 2008 Gauging, Boeing Tract 1, St. Louis, Missouri*, Memorandum dated June 4, 2009, prepared by RAM.

  This memo documented the horizontal flow gradients for the shallow and deep groundwater zones, as well as the vertical gradient between the zones based on the November 2008 gauging data. Of the 57 wells gauged (48 shallow, 3 intermediate, 5 deep, and 1 backfill), the average groundwater depths from top of casing (toc) were 5.6 ft for shallow wells, 7.3 ft for intermediate wells, and 12.9 ft for deep wells.

  The average horizontal groundwater flow gradients were to the east at 0.01 ft/ft for the shallow zone and to the south and southeast at 0.009 ft/ft in the deep zone.

  The vertical flow gradients between the shallow and deep zones were downward in Sub-areas 2B, 3D, and 8A (0.019 to 0.294 ft/ft), and upward in 6B, 6C, and 6D (0.018 to 0.135 ft/ft).

The vertical flow gradients between the shallow and intermediate zones were variable ranging from 0.011 ft/ft upward to 0.115 ft/ft downward in Sub-area 2B.

The vertical flow gradient between the intermediate and deep zones was downward in Sub-area 2B at a gradient of 0.539 ft/ft.

The results were consistent with the RFI Report for gauging data collected in August and December 2002 and March and June 2003.

SECTION 2.0
APPROACH FOR INVESTIGATION AND EVALUATION OF POTENTIAL REMEDIES

2.1 GENERAL APPROACH

Table 2-1 presents the eleven Sub-areas with risk and hazard exceedences based on the combined results of the RAM Group and Tetra Tech risk assessments. The table also shows the COCs primarily causing the exceedences and the routes of exposure. These exceedences will be addressed by the CMS.

2.1.1 Re-evaluation of Risks

The previous risk assessments were based on groundwater data collected up to 2004. Additional groundwater data has been collected in 2005 as part of the soil interim action excavations and in November 2008 during a site-wide groundwater sampling event. Representative groundwater concentrations will be re-calculated to include the data collected since 2004 and used to re-calculate risks. Any Sub-areas with unacceptable risks will be addressed in the CMS.

2.1.2 Treatment of Total Petroleum Hydrocarbons (TPH)

Eleven Sub-areas (2A, 2B, 2C, 3A, 3C, 3E, 3G, 3H, 6B, 6C, and 8B) have been identified with unacceptable risks due to exposures related to groundwater impacts. In all of those Sub-areas, TPH concentrations in groundwater present an unacceptable risk to workers due to either indoor or outdoor inhalation of vapors from groundwater. These exceedences are most likely due to the very conservative manner used to calculate risks associated with TPH. Also, in Sub-areas 2C, 3H, and 6B unacceptable inhalation risks are present due to specific chemicals (benzene, mercury, 1,2-dichloroethene (total), trichloroethene, and vinyl chloride) in groundwater.

Therefore, Boeing will perform site-specific soil vapor sampling for the various TPH aliphatic and aromatic carbon fractions and the specific chemicals causing the exceedences and use those results to calculate representative soil vapor concentrations for each Sub-area. The representative concentrations will be used to estimate indoor and outdoor vapor concentrations using models and site specific soil geotechnical parameters and building and pavement characteristics. The representative indoor and outdoor vapor concentrations will be used to re-calculate risk to the affected workers.

Any Sub-areas with unacceptable risks will be addressed by the CMS and alternative remedial actions will be evaluated. The soil vapor sampling work plan is provided in Appendix B.

2.1.3 Plume Stability and Monitored Natural Attenuation (MNA)

Plume stability and natural attenuation will be evaluated by the CMS using the updated groundwater database that includes the groundwater data collected since 2004. For Sub-areas that present unacceptable risks based on the re-calculations discussed above in Sections 2.1.1 and 2.1.2 and / or do not show a stable or decreasing plume, an on-going groundwater monitoring plan will be developed. The plan will use monitoring wells and piezometers selected from the 57 currently available for use. The monitoring plan will include the specific wells / piezometers to be sampled, the frequency of sampling, the specific chemicals to be analyzed and methods, the reporting criteria, the end-point conditions to be met in order to cease monitoring, and the expected term of sampling.

Plume stability analysis will be evaluated using qualitative and statistical tools. The qualitative tools will include concentration vs. time and concentration vs. distance plots and concentration contour maps over various time periods. The statistical tools will include the Mann Kendall test and possibly regression analysis. It is not anticipated that quantitation tools will be used, such as the mass flux, center of mass, or total mass in plume approaches. Determination of plume stability will be in accordance with Section 6.13.2 of the Departmental MRBCA Guidance Document (MDNR, April 2006, Updated June 2006 and June 2008). Alternatives may be evaluated for use in hastening plume stability.

Monitored natural attenuation (MNA) will be one of the alternatives considered for some Sub-areas. An MNA plan will be prepared that will identify the specific wells / piezometers to be included, the specific parameters to be analyzed in the field and in the laboratory, the frequency of sampling, and the evaluation and reporting criteria to be used. The occurrence and rate of natural attenuation will be determined in accordance with Section 6.8.4 of the Departmental MRBCA Guidance Document (MDNR, April 2006, Updated June 2006 and June 2008), likely using primary and secondary lines of evidence.

The monitoring wells and piezometers, a total of 57 listed in the following table are available for sampling. The locations of these wells/piezometers are shown on Figure 1-2. The screened intervals are as follows:

- Backfill - 0-10 ft bgs
- Shallow zone – 2-26 ft bgs
- Intermediate zone – 32-42 ft bgs
- Deep zone – 56-80.5 ft bgs

Wells / Piezometers Available for Sampling

Backfill	**Shallow Zone**	**Shallow Zone**	**Shallow Zone**
SWMW17-OB-I	B4MW-9	MW-9S	RC14
Shallow Zone	MW1	MW-A1	RC8D
B220N4	MW10S	MW-A12	TP-3
B220N6	MW-10S	MW-A13	TP-4
B25MW1	MW-11S	MW-A15	TP-6
B27W3D	MW3	MW-A16	**Intermediate Zone**
B28MW3	MW4	MW-A22	MW-11I
B28MW4	MW5CS	MW-A23	MW-5I
B2E3	MW5DS	MW-A25	MW-8I
B2E5	MW6	MW-A26	**Deep Zone**
B41MW-18	MW-6S	MW-A27	B41S5D
B41MW-5	MW7	MW-A29	MW10D
B42N6	MW8AS	MW-A3	MW-11D
B48N1	MW-8S	MW-A4	MW6D
B4MW-10	MW9S	MW-A8	MW8AD

We believe there are sufficient piezometers and monitoring wells to develop a monitoring plan for the evaluation of plume stability and MNA. However, if additional wells are necessary, wells will be installed.

2.1.4 Activity and Use Limitations (AULs)

Boeing is working with the agencies on acceptable activity and use limitation language, documentation, and recordation. The AULs will be in accordance with Section 11 and Appendix J of the Departmental MRBCA Guidance Document (MDNR, April 2006, Updated June 2006 and June 2008) and the Missouri Environmental Covenants Act and will be used to prevent future use of groundwater at the facility for potable purposes and will restrict future use of the facility to commercial purposes. The AULs will be durable, reliable, and enforceable. The proposed AUL language is presented in Appendix C.

2.2 EVALUATION AND SELECTION OF REMEDIAL ALTERNATIVES

Based on the results of the evaluations presented in Section 2.1 above, some Sub-areas with remaining unacceptable risks may require additional actions and possibly active remediation. Remedial alternatives will be evaluated for these areas.

A preliminary evaluation of the proposed remedial alternatives will be performed using the following criteria:

1. Protect human health and the environment;
2. Attain media cleanup standards;
3. Control of sources of releases; and
4. Comply with any applicable standards for management of wastes.

The following five decision factors will be considered in the selection process for the proposed remedy:

1. Long-term reliability and effectiveness;
2. Reduction in the toxicity, mobility, or volume of wastes;
3. Short-term effectiveness;
4. Implementability; and
5. Cost.

2.3 RISK MANAGEMENT PLAN

The CMS result will be to identify any Sub-areas with remaining unacceptable risk, recommend alternatives to address those specific issues, develop media-specific clean-up levels, and develop a risk management plan to present the steps and schedule needed to implement the corrective action. The Risk Management Plan will be prepared in accordance with Section 12 of the Departmental MRBCA Guidance Document (MDNR, April 2006, Updated June 2006 and June 2008).

2.4 CMS PROJECT SCHEDULE

Upon approval of this work plan and an outline of the CMS report, a CMS project schedule will be developed to meet Boeing and agencies schedule.

2.5 PERSONNEL

The key personnel that will be involved in the CMS are as follows:

- Atul M. Salhotra, Ph.D. – Project Manager and Principal Professional
- Cliff W. Wright, P.E. – Senior Engineer and Missouri Professional Engineer
- Sungmi Moon, Ph.D. – Senior Engineer
- Kendall L. Pickett – Senior Geologist

Resumes for the above personnel are available upon request.

Additional support engineers, scientists, and administrative personnel in RAM Group's Houston and St. Louis offices will be utilized on an as needed basis.

SECTION 3.0
REFERENCES

1. MACTEC Engineering and Consulting, Inc. (MACTEC). *2004. RCRA Facility Investigation Report for McDonnell Douglas, Hazelwood, Missouri*, dated December.

2. MACTEC. 2006. *Interim Action Remedial Excavation Completion Report, Boeing Tract 1, McDonnell Douglas, Hazelwood, Missouri*, report dated May.

3. MACTEC. 2006. *Interim Measure Completion Report, Solid Waste Management Unit 17, McDonnell Douglas, Hazelwood, Missouri*, report dated June.

4. Missouri Department of Natural Resources (MDNR). 1997. *McDonnell Douglas' Missouri Hazardous Waste Management Facility Part I Permit MOD 000818963*, dated March 5.

5. MDNR. 2006, 2008. *Departmental Missouri Risk-Based Corrective Action (MRBCA) Technical Guidance*, dated April 2006, updated June 2006 and June 2008).

6. MDNR. 2009. Risk-Based Corrective Action Report, Boeing Tract 1 Dated September 2004, Addendums to Risk-Based Corrective Action Report Dated June 29, 2009, and Dated July 29, 2009, The Boeing Company, Hazelwood, Missouri, EPA ID# MOD000818963, letter dated August 24.

7. Missouri General Assembly. 2008. *Missouri Environmental Covenants Act.* Missouri Revised Statues, Chapter 260, Environmental Control, Sections 260.1000 – 260.1039, Effective January 1, 2008.

8. Risk Assessment & Management Group, Inc. (RAM). 2004. *Risk-Based Corrective Action Report, Boeing Tract 1, St. Louis, Missouri*, dated September.

9. RAM Group of Gannett Fleming, Inc. (RAM Group). 2009. *November 2008 Groundwater Sampling Data Compilation Report, Boeing Tract 1, Hazelwood, Missouri,* dated January 16.

10. RAM Group. 2009. *Changes in Groundwater Concentrations per November/December 2008 Sampling Event, Boeing Tract 1, St. Louis, Missouri*, Memorandum dated May 8.

11. RAM Group. 2009. *Groundwater Flow Gradient – Shallow and Deep Groundwater Zones, November 17-19, 2008 Gauging, Boeing Tract 1, St. Louis, Missouri*, Memorandum dated June 4.

12. RAM Group. 2009. *Revised Addendum A Protection of Surface Water*, addendum to risk assessment dated June 4.

13. RAM Group. 2009. *Effect of Changes in Toxicity Values and Exposure Factors on Risks, Response to Outstanding Comment on Boeing RBCA Report Dated September 2004, Hazelwood, Missouri*, addendum to risk assessment dated July 24.

14. RAM Group. 2009. *Soil Vapor Sampling Work Plan, Boeing Tract 1, Facility, St. Louis,* Missouri, dated August 2009.

15. Tetra Tech EM, Inc. (Tetra Tech). 2008. *U.S. Environmental Protection Agency Final Risk Assessment, Boeing Tract 1 Facility, St. Louis, Missouri*, report dated March.

16. United States Environmental Protection Agency (USEPA). 1994. *RCRA Corrective Action Plan (Final),* OSWER Directive 9902.3-2A, dated May.

Table 1-1
Approved Risk Assessment Exposure Areas
Boeing Tract 1, Hazelwood, Missouri

AREA	SUB-AREA	DESCRIPTION
Area 1		Runway Protection Zone: (includes former Buildings 40, 45L, 45C, 45D, 45E, and parts of 45 and 45K).
Area 2		Demolished Area: (includes former Buildings 45J, 51, 52, 48, 48A, and part of 45K).
	Sub-area 2A	Western portions of Buildings 45J, 51, and 52, northwestern corner of Building 45, northern portion of Building 45K, and parking lots, entrance road, and open space between these buildings and the west property line.
	Sub-area 2B	Eastern portion of Buildings 45J, 51, and 52, northwestern portion of Building 45, western portions of Buildings 48 and 48A, smaller associated buildings, and associated parking lots and access areas.
	Sub-area 2C	Eastern portions of Buildings 48 and 48A, northeastern portion of Building 45, smaller associated buildings, and associated parking lots and access areas.
Area 3		Retained Area: (includes Buildings 42, 43, 45H, 41, 44, 44A, 46, 49, 1, 2, 3, and 4).
	Sub-area 3A	Buildings/structures 44, 44A, 46, and 49, western portion of Building 41, northern edge of Building 42, and associated parking lots and access areas primarily to the west and south of these buildings.
	Sub-area 3B	Small open area between Buildings 2 and 42 including the parking access area on the western side of Building 2.
	Sub-area 3C	All but the northern edge of Building 42, several buildings/structures to the south of Building 42, and associated paved parking and access areas primarily to the east and south of these buildings to the runway on the south.
	Sub-area 3D	Eastern portion of Buildings 41, northern half of Building 2, and the associated open and parking areas on the west side of Building 2.
	Sub-area 3E	Small open area between Buildings 2 and 4 including parking and access areas.
	Sub-area 3F	Small rectangular area at the southwestern corner of Building 1, including parking and access areas and the southwest corner of Building 1.
	Sub-area 3G	Small rectangular area between Buildings 1, 2, and 3, including parking and access areas and the northeastern portion of Building 1 and the northwestern portion of Building 3.
	Sub-area 3H	Building 4 and the open access areas to the north, east, and south sides of the building.
Area 4		Power Plant: (includes Buildings 5 and 6).
Area 5		Industrial Water Treatment Plant: (includes Building 14).
Area 6		GKN Facility: (includes Buildings 21, 22, 25, 27, 28, 29, 29A, and 39).
	Sub-area 6A	Buildings 21, 29, and 29A, and all parking lots and open space to the south and west of these buildings.
	Sub-area 6B	The area between Buildings 29 and 27, containing Buildings 22, 28, 39.
	Sub-area 6C	Buildings 25 and 27 and parking lots and open space to the south of these buildings and within about 450 feet to the east.
	Sub-area 6D	Parking lots and open areas beginning about 450 feet east of Buildings 25 and 27 and extending to the north, south, and east property lines.
Area 7		Engineering Campus: (includes Buildings 27A, 32, 33, and 34).
Area 8		Office Complex North: (includes Buildings 220 and 221).
	Sub-area 8A	Southern portion of Building 220, associated parking areas to the south and access areas to the east.
	Sub-area 8B	Northern portion of Building 220 and the open area to the northwest of the building to the property boundary including smaller associated buildings, parking areas, and unpaved areas along the property boundary.
	Sub-area 8C	Building 221 and the associated parking and access areas to the north, east, and west of the building.
Area 9		Gun Range: (includes Buildings 10, 11, 11A, 12, and 13).

Table 1-2
Approved Chemicals of Concern (COCs)
RAM Group Risk Assessment
Boring Tract 1, Hazelwood, Missouri

COCs	Area 1	Sub-area 2A	Sub-area 2B	Sub-area 2C	Sub-area 3A	Sub-area 3B	Sub-area 3C	Sub-area 3D	Sub-area 3E	Sub-area 3F	Sub-area 3G	Sub-area 3H	Area 4	Area 5	Sub-area 6A	Sub-area 6B	Sub-area 6C	Sub-area 6D	Sub-area 8A	Sub-area 8B	Sub-area 8C	Area 9
1,1-Dichloroethane																X						
1,1-Dichloroethene			X					X								X						
1,1,2-Trichloro-1,2,2-trifluoroethane																X						
1,2,3-Trimethylbenzene	X		X													X						
1,2,4-Trimethylbenzene	X		X		X			X	X		X					X						
1,3,5-Trimethylbenzene					X			X			X											
2-Hexanone																	X					
Acetone	X		X			X	X		X		X	X	X		X	X	X		X		X	X
Benzene	X	X	X	X	X	X	X	X	X		X				X	X						
Bromomethane																X						
Carbazole													X									
Carbon disulfide						X																
Chloroethane			X					X														
Chloroform																	X					
cis-1,2-Dichloroethene			X		X											X	X		X			
Dichlorodifluoromethane		X														X	X	X				
Ethylbenzene	X	X	X	X	X	X		X	X		X					X	X					
Isopropylbenzene			X		X	X	X	X	X													
m,p-Xylene			X		X			X	X		X											
Methylene chloride		X	X	X	X		X		X			X	X			X			X			X
Methyl ethyl ketone			X									X	X		X	X	X	X	X	X		
Methyl isobutyl ketone																	X					
Methyl tert-butyl ether			X				X		X		X					X						
Naphthalene			X						X		X											X
n-Butylbenzene			X				X	X	X													
n-Propylbenzene	X		X		X	X	X	X	X													
o-Xylene			X					X			X						X					
p-Isopropyltoluene			X		X			X			X											
sec-Butylbenzene			X		X	X	X	X	X													
tert-Butylbenzene							X	X														
Tetrachloroethene		X	X					X								X		X			X	
Toluene	X	X	X	X	X	X	X		X		X		X			X		X	X			X
trans-1,2-Dichlorobenzene																X						
trans-1,2-Dichloroethene			X													X						
Trichloroethene		X	X					X								X	X		X			
Vinyl chloride			X		X			X								X	X		X			
Xylenes, Total	X	X	X	X	X	X	X	X	X		X	X	X			X	X					
Aroclor 1254																X						
Acenaphthene																X						
Acenaphthylene																X						
Anthracene													X									
Benzo(a)anthracene													X			X	X					
Benzo(a)pyrene								X					X									
Benzo(b)fluoranthene													X			X	X			X		
Benzo(g,h,i)perylene													X									
Benzo(k)fluoranthene													X									
Chrysene													X		X	X	X			X		
Dibenzo(a,g)anthracene													X									
Fluoranthene													X			X	X					
Fluorene																X						
Indeno(1,2,3-cd)pyrene													X									
Phenanthrene													X			X						
Pyrene													X			X						
Total Organics	**8**	**8**	**25**	**5**	**14**	**9**	**11**	**19**	**14**	**0**	**12**	**4**	**18**	**0**	**4**	**31**	**16**	**4**	**7**	**3**	**2**	**4**

Table 1-2
Approved Chemicals of Concern (COCs)
RAM Group Risk Assessment
Boring Tract 1, Hazelwood, Missouri

COCs	Area 1	Sub-area 2A	Sub-area 2B	Sub-area 2C	Sub-area 3A	Sub-area 3B	Sub-area 3C	Sub-area 3D	Sub-area 3E	Sub-area 3F	Sub-area 3G	Sub-area 3H	Area 4	Area 5	Sub-area 6A	Sub-area 6B	Sub-area 6C	Sub-area 6D	Sub-area 8A	Sub-area 8B	Sub-area 8C	Area 9
Aliphatics > nC6 to nC8 (TX1006)			X			X			X		X					X	X			X		
Aliphatics > nC8 to nC10 (TX1006)			X			X			X		X					X	X			X		
Aromatics > nC8 to nC10 (TX1006)			X			X			X		X					X	X			X		
TPH-GRO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X
Aliphatics > nC10 to nC12 (TX1006)			X			X			X		X					X	X			X		
Aliphatics > nC12 to nC16 (TX1006)			X			X			X		X					X	X			X		
Aliphatics > nC16 to nC21 (TX1006)			X			X			X		X					X	X			X		
Aromatics > nC10 to nC12 (TX1006)			X			X			X		X					X	X			X		
Aromatics > nC12 to nC16 (TX1006)			X			X			X		X					X	X			X		
Aromatics > nC16 to nC21 (TX1006)			X			X			X		X					X	X			X		
TPH-DRO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X
Aliphatics > nC21 to nC35 (TX1006)			X			X			X		X					X	X			X		
Aromatics > nC21 to nC35 (TX1006)			X			X			X		X					X	X			X		
TPH-ORO	X	X	X	X	X	X	X	X	X	X	X	X	X					X				X
Total TPH	**3**	**3**	**14**	**3**	**3**	**14**	**3**	**3**	**14**	**3**	**14**	**3**	**3**	**2**	**2**	**13**	**13**	**3**	**0**	**11**	**2**	**3**
Aluminum																						
Antimony	X	X	X													X						
Arsenic	X	X	X		X			X				X	X	X	X	X	X	X	X	X		X
Barium								X							X	X	X		X			X
Beryllium	X	X	X					X								X						X
Cadmium		X	X					X							X	X	X					X
Chromium			X					X						X	X	X	X	X	X	X		X
Chromium, hexavalent																	X					
Cobalt	X	X	X													X						
Copper	X	X	X					X								X						X
Cyanide, total														X								
Manganese	X		X					X				X	X			X			X			X
Mercury	X	X	X		X									X		X	X		X	X		X
Nickel	X	X	X					X						X		X						X
Selenium	X		X					X					X	X	X	X	X					X
Silver			X																			X
Thallium			X					X														
Vanadium																						
Zinc		X	X					X								X						X
Total Metals	**9**	**9**	**14**	**0**	**2**	**0**	**0**	**11**	**0**	**0**	**0**	**2**	**3**	**6**	**5**	**13**	**7**	**2**	**5**	**3**	**0**	**12**
TOTAL COCs	**20**	**20**	**53**	**8**	**19**	**23**	**14**	**33**	**28**	**3**	**26**	**9**	**24**	**8**	**11**	**57**	**36**	**9**	**12**	**17**	**4**	**19**

Notes:
X: COC
C: carbon range
TPH: total petroleum hydrocarbons
GRO: gasoline range hydrocarbons
DRO: diesel range hydrocarbons
ORO: oil range hydrocarbons
Area 7 - No risk calculation was performed since there is only one sample location and no industrial activities

Table 1-3
RAM Group Summary of Risks
Boeing Tract 1, Hazelwood, Missouri

Area	Non-residential Worker		Construction Worker	
	IELCR	HI	IELCR	HI
Area 1 (Max.)	N/A	N/A	6.34E-07	0.50
Sub-area 2A	5.97E-08	**22**	3.52E-07	0.31
Sub-area 2B	7.57E-06	**96**	1.89E-05	**3.1**
Sub-area 2C	2.02E-08	0.95	3.92E-08	0.047
Sub-area 3A	7.90E-08	**2.6**	4.52E-08	0.055
Sub-area 3B	3.35E-09	0.31	4.66E-10	0.0071
Sub-area 3C	2.00E-08	**77**	2.34E-08	**1.3**
Sub-area 3D	2.93E-08	0.075	1.17E-07	0.048
Sub-area 3E	4.31E-08	**10**	8.02E-10	0.12
Sub-area 3F	NA	0.86	NA	0.0082
Sub-area 3G	6.02E-08	**2.8**	9.38E-08	0.12
Sub-area 3H	NA	0.70	6.35E-13	0.0058
Area 4	2.17E-10	0.47	2.60E-06	0.014
Area 5	NA	0.00053	6.37E-08	0.013
Sub-area 6A	1.12E-10	0.054	5.33E-08	0.0089
Sub-area 6B	1.44E-06	**7.9**	2.44E-05	0.17
Sub-area 6C	7.03E-08	**4.1**	8.36E-08	0.060
Sub-area 6D	2.99E-10	0.00014	8.25E-08	0.013
Sub-area 8A	2.37E-08	0.00031	1.02E-07	0.020
Sub-area 8B	NA	**55**	3.74E-10	0.49
Sub-area 8C	NA	0.064	1.25E-12	0.0052
Area 9	1.79E-11	0.19	1.29E-11	0.008

Notes:

Number in bold exceeds the cumulative acceptable target levels.

IELCR: Individual excess lifetime cancer risk

HI: Hazard index

NA: Not available

N/A: Not applicable

Area 7 - No risk calculation was performed since there is only one sample location and no industrial activities.

Table 1-4
Summary of Interim Action Remedial Excavations in 2005
Boeing Tract 1, Hazelwood, Missouri

Sub-area	Dimension of Excavated Area	Mass of Soil Excavated (tons)	Samples Excavated/Reference Table		Available Piezometers / Wells
Sub-area 2B	20 ft x 20 ft x 10 ft depth	2073.15 105.1 hazardous waste	B51I1 TP-1 (SB-1) TP-2 (SB-3) SB-4 TP-5 (SB-11) MW-7S (SB-14) SB-18	Table 3B-5(a) Table 3B-5(c) Table 3B-7(a) Table 3B-7(b) Table 3B-7(c)	MW-5I MW-6S MW-10S MW-11D MW-11I MW-11S TP-6 MW-8I MW-8S MW-9S
Sub-area 3A	11.5 ft x 9.5 ft x 8 ft depth	88.23	B42N5	Table 4A-5(a) Table 4A-5(b) Table 4A-5(c) Table 4A-7(a) Table 4A-7(b) Table 4A-7(c)	B42N6 B41MW-18
Sub-area 3E	7 ft x 8 ft x 4 ft depth	8.12	B2E2	Table 4E-7(a) Table 4E-7(b) Table 4E-7(c)	B2E3 B2E5
Sub-area 6B	15 ft x 15 ft x 6 ft depth	56.35	RC2 RC9	Table 7B-7(a) Table 7B-7(b) Table 7B-7(c) Table 7B-7(d) Table 7B-7(e)	RC14 MW3 MW7 MW9S B27W3D B28MW3 B28MW4
Sub-area 8B	10 ft x 10 ft x 5 ft depth	23.02	B220N1	Table 9B-8(b)	B220N4 B220N6 MW4

References:

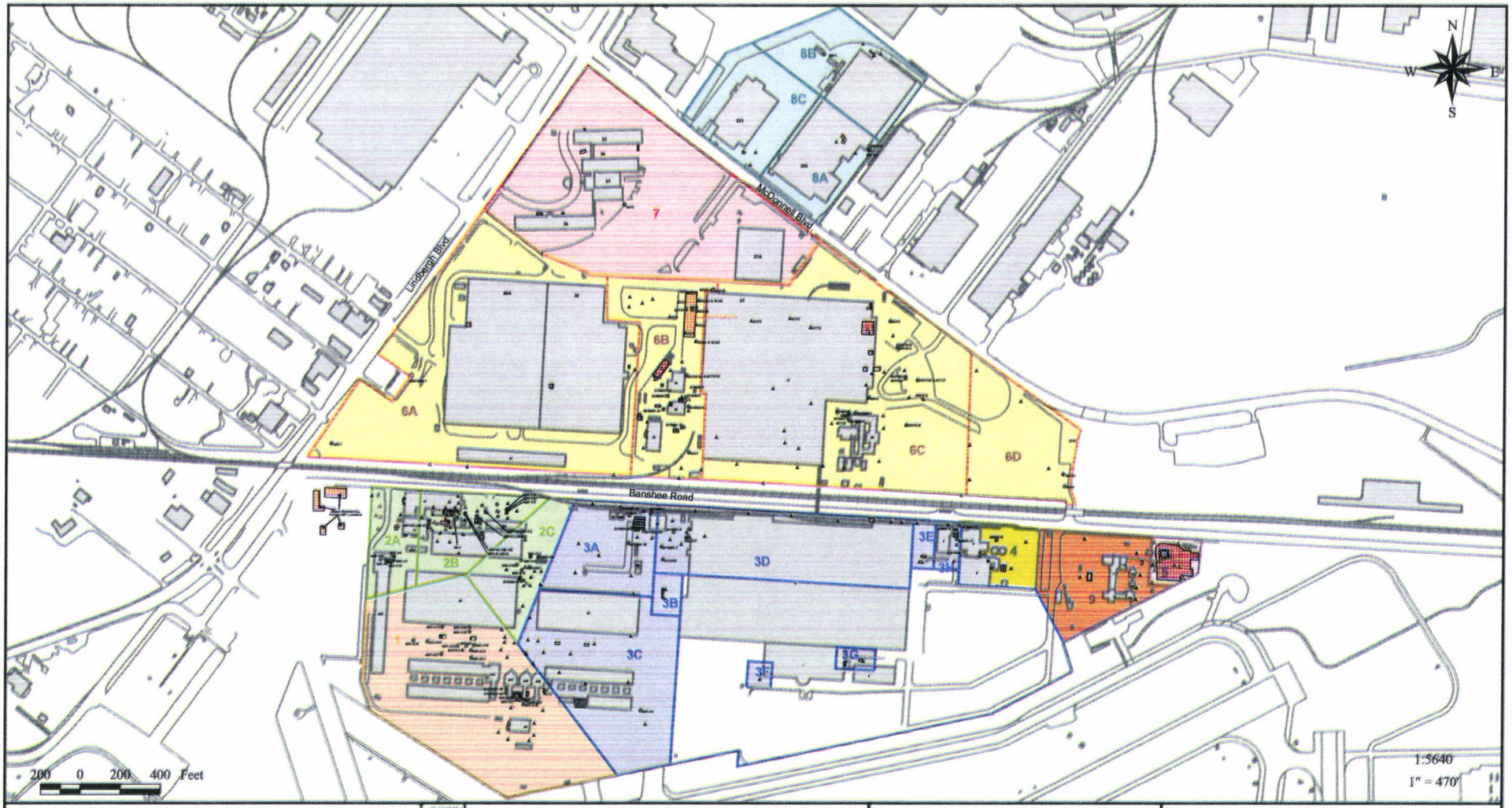
Mactec, May 2006. Interim Action Remedial Excavation Completion Report, Boeing Tract 1, McDonnell Douglas, Hazelwood, Missouri.
Mactec, June 2006. Interim Measure Completion Report, Solid Waste Management Unit 17, McDonnell Douglas, Hazelwood, Missouri.

Table 2-1
Primary Chemicals and Routes of Exposure that Caused Risk and Hazard Exceedences
Combined RAM Group and Tetra Tech Risk Assessments
Boeing Tract 1, Hazelwood, Missouri

Area	COC	Media	Exceedence Due to	Risk Assessment
Sub-area 2A	TPH-GRO	GW	Indoor inhalation from groundwater by non-residential worker	RAM Group
	TPH-DRO	GW	Indoor inhalation from groundwater by non-residential worker	
Sub-area 2B	Aliphatics >nC12 to nC16	GW	Indoor inhalation from groundwater by non-residential worker	
	Aliphatics >nC16 to nC21	GW	Indoor inhalation from groundwater by non-residential worker	
	Aliphatics >nC21 to nC35	GW	Indoor inhalation from groundwater by non-residential worker	
	Tetrachloroethene	GW	Dermal contact with groundwater by future construction worker	
Sub-area 2C	Benzene	GW	Outdoor inhalation of vapors from groundwater by future construction worker	Tetra Tech
	TPH-GRO Aliphatics >nC5 to nC8	GW	Outdoor inhalation of vapors from groundwater by outdoor worker and future construction worker	
	TPH-GRO Aliphatics >nC9 to nC18	GW	Outdoor inhalation of vapors from groundwater by outdoor worker and future construction worker	
	TPH-GRO Aromatics >nC9 to nC18	GW	Outdoor inhalation of vapors from groundwater by future construction worker	
Sub-area 3A	TPH-DRO	GW	Indoor inhalation from groundwater by non-residential worker	RAM Group
Sub-area 3C	TPH-DRO	GW	Indoor inhalation from groundwater by non-residential worker	
	TPH-ORO	GW	Indoor inhalation from groundwater by non-residential worker	
	Total TPH	GW	Outdoor inhalation of vapors from groundwater by construction worker	
Sub-area 3E	Aliphatics >nC16 to nC21	GW	Indoor inhalation from groundwater by non-residential worker	
Sub-area 3G	Aliphatics >nC21 to nC35	GW	Indoor inhalation from groundwater by non-residential worker	
Sub-area 3H	Mercury	GW	Outdoor inhalation of vapors from groundwater by future construction worker	Tetra Tech
	TPH-DRO Aliphatics >nC9 to nC18	GW	Outdoor inhalation of vapors from groundwater by future construction worker	
	TPH-DRO Aromatics >nC9 to nC18	GW	Outdoor inhalation of vapors from groundwater by future construction worker	
Sub-area 6B	Aliphatics >nC16 to nC21	GW	Indoor inhalation from groundwater by non-residential worker	RAM Group
	Benzo(a)anthracene	GW	Dermal contact with groundwater by construction worker	
	1,2-dichloroethene (total)	GW	Outdoor inhalation of vapors from groundwater by future construction worker	Tetra Tech
	Benzene	GW	Outdoor inhalation of vapors from groundwater by future construction worker	
	Trichloroethene	GW	Outdoor inhalation of vapors from groundwater and dermal contact with groundwater by future construction worker	
	Vinyl chloride	GW	Outdoor inhalation of vapors from groundwater by future construction worker	
	Mercury	GW	Outdoor inhalation of vapors from groundwater by future construction worker	
	Aroclor 1254	GW	Dermal contact with groundwater by future construction worker	
	TPH-GRO Aliphatics >nC5 to nC8	GW	Outdoor inhalation of vapors from groundwater by future construction worker	
	TPH-GRO Aliphatics >nC9 to nC18	GW	Outdoor inhalation of vapors from groundwater by future construction worker	
	TPH-GRO Aromatics >nC9 to nC18	GW	Outdoor inhalation of vapors from groundwater by future construction worker	
	TPH-DRO Aliphatics >nC9 to nC18	GW	Outdoor inhalation of vapors from groundwater by outdoor worker and future construction worker	
	TPH-DRO Aromatics >nC9 to nC18	GW	Outdoor inhalation of vapors from groundwater by future construction worker	
Sub-area 6C	Aliphatics >nC16 to nC21	GW	Indoor inhalation from groundwater by non-residential worker	RAM Group
	Aliphatics >nC21 to nC35	GW	Indoor inhalation from groundwater by non-residential worker	
Sub-area 8B	Aliphatics >nC16 to nC21	GW	Indoor inhalation from groundwater by non-residential worker	
	Aliphatics >nC21 to nC35	GW	Indoor inhalation from groundwater by non-residential worker	

Notes:
TPH - total petroleum hydrocarbons
GRO - gasoline range organics
DRO - diesel range organics
ORO - oil range organics
C - carbon range
GW - groundwater

FIGURES



Legend

- Abandoned Shallow Piezometer
- Abandoned Shallow Well
- Deep Piezometer
- Deep Well
- Intermediate Well
- Other Shallow Boring
- RFA Boring
- RCRA Closure Shallow Boring
- RFI Deep Boring/Temp. Piezometer
- RFI Shallow Boring
- RFI Shallow Boring/Temp. Piezometer
- Shallow Piezometer
- Shallow Well
- UST Closure Sample
- Other Area
- UST
- SWMU

Drawn by: BSM Approved by:

Checked by: Date: September 10, 2004

Risk Assessment & Management Group, Inc.

Figure 1-1
Risk Assessment Exposure Area Map, Boeing Tract 1 (North and South)

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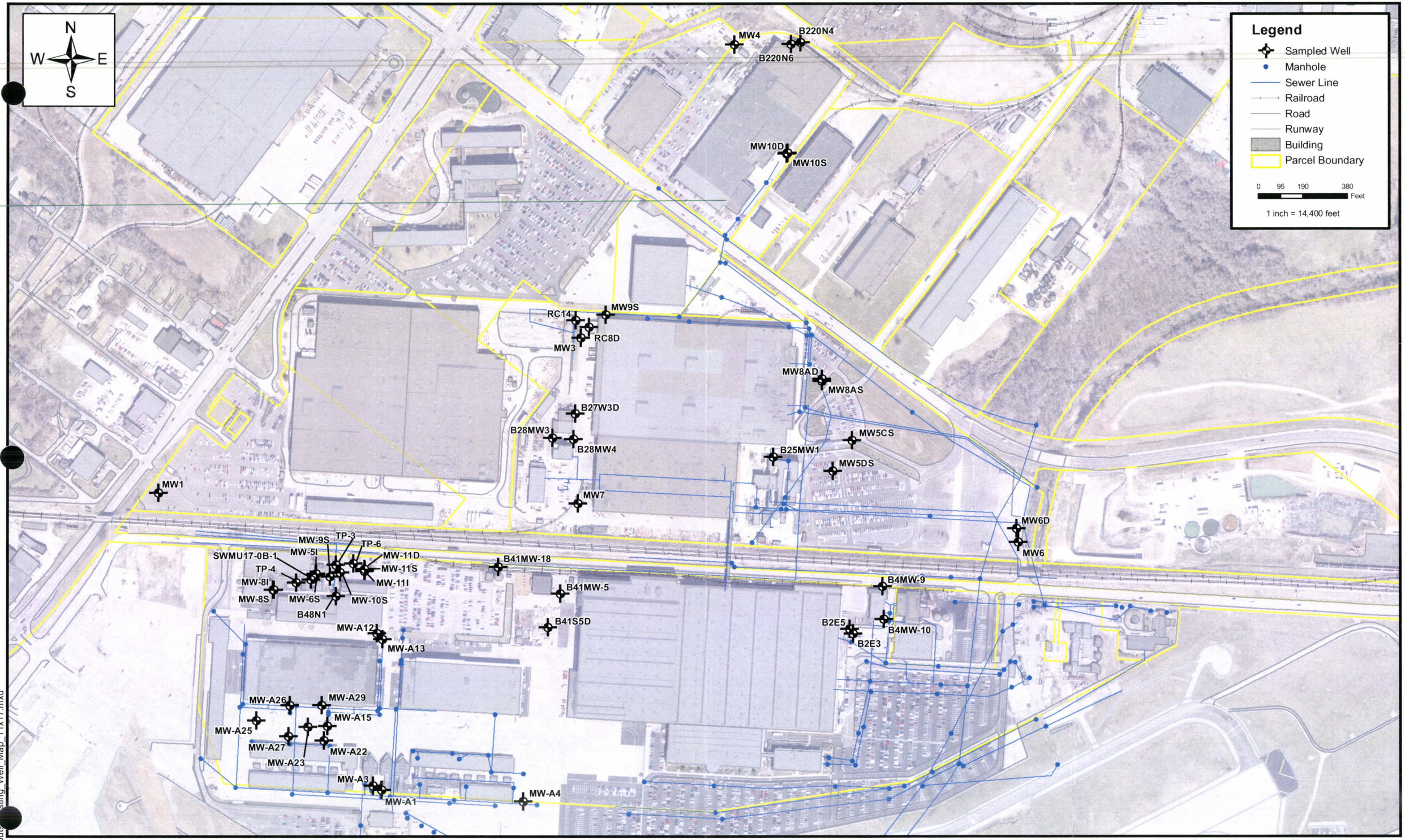


J:\Boeing\Layouts\Existing_Well_Map_11x17.mxd

NO.	REVISIONS	DATE	BY	DESIGNED	GIS	SCALE	Gannett Fleming	Report Wells	Locations of Monitoring Wells	GF PROJECT NO.	SHEET NO.
	DESCRIPTION			DKB	CER	AS NOTED	BALTIMORE, MARYLAND			49992	1-2
				CHECKED	APPROVED					DATE 11-17-09	
										GIS FILE Existing_Well_Map_11x17.mxd	

Appendix A
Agencies Approval of RAM Group Risk Assessment Letter Dated August 24, 2009

Jeremiah W. (Jay) Nixon, Governor • Mark N. Templeton, Director
DEPARTMENT OF NATURAL RESOURCES
www.dnr.mo.gov

August 24, 2009

CERTIFIED MAIL – 7004 1160 0000 8177 3797
RETURN RECEIPT REQUESTED

Mr. Joseph W. Haake
Group Manager
Environmental and Hazardous
Materials Services
The Boeing Company
Department 107E, Building 111
Mail Code S111-2491
P.O. Box 516
St. Louis, MO 63166-0516

RE: Risk-Based Corrective Action Report, Boeing Tract 1 Dated September 2004
Addendums to Risk-Based Corrective Action Report Dated June 29, 2009, and
Dated July 29, 2009, The Boeing Company, Hazelwood, Missouri
EPA ID# MOD000818963

Dear Mr. Haake:

This letter is to notify you that the Missouri Department of Natural Resources and the U.S. Environmental Protection Agency Region VII (EPA) reviewed The Boeing Company's Risk-Based Corrective Action Report, Boeing Tract 1, dated September 2004 and associated addendums dated June 29, 2009 and July 29, 2009. The Boeing Company submitted these documents as required by McDonnell Douglas' (a wholly owned subsidiary of The Boeing Company) Missouri Hazardous Waste Management Facility Part I Permit, Schedule of Compliance, Condition II, dated March 5, 1997. We are approving these documents based on our review.

Based on the results of the Resource Conservation and Recovery Act Facility Investigation Report approved on December 22, 2004, the Risk-Based Corrective Action Report, Boeing Tract 1, dated September 2004 and associated addendums dated June 29 and July 29, 2009, and the EPA's Final Risk Assessment, Boeing Tract 1 Facility, dated March 2008, the agencies' request

Boeing progress to the next phase of the Corrective Action process and prepare a Corrective Measures Study (CMS) Work Plan in accordance with Section VII., CMS Work Plan of the Missouri Hazardous Waste Management Facility Part I Permit.

The CMS Work Plan shall be consistent with guidance contained in the EPA document entitled: RCRA Corrective Action Plan (Final), May 1994, OSWER Directive 9902.3-2A. The CMS Work Plan shall outline the general approach to investigating and evaluating potential remedies at the facility, including a description of all remedies that will be studied and a detailed description of any proposed pilot, laboratory, and/or bench scale studies.

Please submit the CMS Work Plan within 60 days of your receipt of this approval letter. Please submit three copies addressed to the Permits Section Chief, Hazardous Waste Program and two copies to Ms. Stephanie Doolan, at U.S. EPA Region VII at 901 North Fifth Street, Kansas City, KS 66101.

If you have any questions regarding this letter, please contact Christine Kump-Mitchell, P.E., of my staff, at the Missouri Department of Natural Resources, 7545 South Lindbergh, Suite 210, St. Louis, MO 63125-4839, or by phone at (314) 416-2960 or 1-800-361-4827, or by e-mail at christine.kump@dnr.mo.gov. Thank you.

Sincerely,

HAZARDOUS WASTE PROGRAM

Richard A. Nussbaum, P.E., R.G.
Chief, Permits Section

RAN:ckm

c: Ms. Stephanie Doolan, Project Manager, U.S. EPA Region VII
Ms. Joletta Golik, Environmental Manager, Lambert St. Louis International Airport
Ms. Christine Jump, Missouri State Coordinator, U.S. EPA Region VII
St. Louis Regional Office

Appendix B
Soil Vapor Sampling Work Plan

SOIL VAPOR SAMPLING WORK PLAN
BOEING TRACT 1 FACILITY, ST. LOUIS, MISSOURI

1.0 BACKGROUND

In the 2004 Risk Assessment (RA) report (RAM Group), the site was divided into 23 areas/sub-areas and the risks were evaluated for each of 23 areas/sub-areas. Of these 23 areas/sub-areas, the following nine sub-areas had exceedences in the non-carcinogenic risk due to indoor inhalation pathway:

- Sub-area 2A
- Sub-area 2B
- Sub-area 3A
- Sub-area 3C
- Sub-area 3E
- Sub-area 3G
- Sub-area 6B
- Sub-area 6C
- Sub-area 8B

Chemicals that caused exceedences were exclusively total petroleum hydrocarbons (TPHs) in groundwater. None of the chemicals of concern (COCs) in soil nor any chemical (other than TPH) in groundwater had exceedences for the indoor inhalation pathway. As has been mentioned previously in RAM Group (2004) and discussed with regulatory agencies, the exceedences are most likely due to the manner in which Missouri Risk-Based Corrective Action (MRBCA) process evaluates risk from TPH (MDNR, April 2006). Specifically, MDNR requires that the groundwater concentrations of TPH carbon fractions be converted using Henry's Law constant to estimate the vapor concentrations of TPH carbon fractions. The migration of these vapor concentrations into the building is used to estimate risks. We believe the calculation of groundwater concentrations to vapor concentrations is overly conservative.

Therefore, to confirm that the exceedences are due to an artifact of the above calculations, it is recommended that soil vapor sampling be performed at a few locations and the results compared with the previously calculated soil vapor concentrations. Note a similar attempt to collect soil vapor samples was made by Boeing in 2006. However, the results were compromised and not considered representative. The location of soil vapor monitoring wells, installation of soil vapor monitoring wells, sample collection procedures, and laboratory analytical procedures are discussed in Section 2.0.

In addition, soil geotechnical parameter samples will be collected. No soil data is necessary because previous soil data collected in 2006 indicate that there are minimal soil impacts (Table 1). There are several detects; however, these are associated with the smear zone and all of the detected concentrations are below Tier 1 risk-based target levels. The details of collection of geotechnical parameter samples and analytical methods are discussed in Section 3.0.

2.0 SOIL VAPOR SAMPLING

2.1 Location of Soil Vapor Monitoring Wells

The following factors were considered to identify the location of soil vapor monitoring wells:

(i) Sub-areas with exceedences of hazard quotient (HQ) for TPH in indoor inhalation pathway were considered. Sub-areas without exceedences in indoor inhalation pathway were not considered.

(ii) Wells with high TPH groundwater concentrations (e.g., MW-9S, RC3) used to estimate the representative concentrations were considered. However, if the wells have TPH results from multiple sampling events and decreasing trend in TPH groundwater concentrations, these wells were not considered (e.g., B51W2, TP-24).

(iii) Wells removed during interim remedial action in 2005 were not considered because highly impacted soil was removed and the groundwater concentrations at those locations are likely lower.

(iv) Location of buildings was not considered since in the future buildings may be constructed at the site and the location of future buildings is unknown. Further the focus is to evaluate the soil vapor concentrations relative to the calculated concentrations.

Based on the above factors, a soil vapor monitoring well will be installed close to each of the following ten groundwater sampling locations from 5 sub-areas:

Sub-area	Groundwater Sample Location
2B	**MW-9S** **TP-7** **TP-14**
3C	B42S2 **B45S11**
3G	B2S2
6B	**RC3** B22N1
6C	B27I9 B25MW4

Figures 3-1, 4-1, and 7-1 from the 2004 RA report (RAM Group, 2004) show the location of groundwater samples identified above.

2.2 Depth of Soil Vapor Samples

Soil vapor samples will be collected approximately at depth of three to four feet below ground surface (ft bgs), but above the capillary fringe. The depths of the soil vapor implants will be determined in the field based on soil conditions and depth to water if encountered in the boring.

Average depth to water for each of the above sub-areas is identified below:

Sub-area	Average Depth to Groundwater (ft bgs)
2B	6.6
3C	4.0
3G	6.7
6B	4.8
6C	10.0

2.3 Installation of Soil Vapor Monitoring Wells

The soil vapor monitoring well borings will be advanced using a Geoprobe® rig. Continuous soil macro cores will be collected during drilling from most borings. The soils will be logged in the field and screened using Photoionization Detector (PID).

The borings will be plugged with granular bentonite to a depth of about one-half foot below the desired depth of the soil vapor implant. Then about one-half foot of #30 sand will be placed above the granular bentonite. The soil vapor implant will then be placed in the borehole to the desired depth and consist of a 6-inch long by 3/8-inch diameter stainless steel mesh implant connected to ¼-inch OD by 1/8-inch ID Teflon tubing that will extend to the surface. A sand pack consisting of glass beads will be installed around each implant to a level of about 6-inches above the implant, then dry granular bentonite to about one foot above the sand pack followed by hydrated granular bentonite to approximately 8-inches below the surface. This will be followed by a thin layer of #30 sand and a 6.5-inch OD by 4-inch ID steel flush mounted manway secured with quickset concrete. The implants will be completed at the surface with Swagelok® end caps.

2.4 Collection of Soil Vapor Samples

Soil vapor samples will be collected using Tenax TA sorbent tubes. A tracer test will be performed using duster spray (containing difluoroethane) to check for the presence of short-circuiting in the sampling system. Household paper towels, wetted with duster spray, will be placed at the surface around the well opening of each soil vapor monitoring well during sampling. *(This may change based on our discussion with lab.)*

The sampling train from inlet to exit will consist of new Teflon tubing with Swagelok connector nut, Swagelok 3-way valve, quick connect receptacle and stem, new Teflon

tubing, Tenax TA sorbent tube, Tygon tubing, and low-flow pump. Using a new 60ml disposable syringe and quick connect stem, the well will be purged of at least three well volumes of vapor. After purging, the sampling train will replace the syringe by using the quick connect stem to connect to the well for sampling. The low-flow pump will pull vapor from the well through the Tenax TA sorbent tube at a pre-determining flow rate and duration to collect an adequate sample volume to obtain a reporting limit at or below the applicable target levels. Field data to be recorded in the field notebook will include weather conditions at time of sampling, purge volume, sampling start and end times, and flow rate.

The samples will be shipped using chain-of-custody protocols by overnight carrier in containers with custody seals to the Air Toxics, Ltd. laboratory in Folsom, California for laboratory analysis.

2.5 Analysis of Soil Vapor Samples

The soil vapor samples will be analyzed for BTEX and TPH using EPA Method TO-17. The TPH results will be reported in the following TPH groups and carbon fractions:

TPH-GRO	TPH-DRO	TPH-ORO
Aliphatics C6 – C8	Aliphatics C10 – C12	Aliphatics C21 – C28*
Aliphatics C8 – C10	Aliphatics C12 – C16	Aromatics C21 – C28*
Aromatics C8 – C10	Aliphatics C16 – C21	
	Aromatics C10 – C12	
	Aromatics C12 – C16	
	Aromatics C16 – C21	

*: MRBCA process requires carbon fractions up to C35; however, C28 is the maximum carbon fraction that laboratory can report.

2.6 Quality Assurance and Quality Control Samples

2.6.1 Field QA/QC

Field quality assurance/quality control (QA/QC) will consist of using clean sampling trains that have been decontaminated prior to use at each well by flushing with ultra pure nitrogen gas for one minute and consisting of new tubing for sampling at each well.

New laboratory-supplied Tenax TA sorbent tubes will be used for sampling.

New Nitrile gloves will be worn throughout the purging and sampling procedures and will be changed as necessary but at least prior to activities at each well.

One trip blank will be provided by the laboratory and will accompany the sorbent tubes from the laboratory, during the sampling activities, and will be returned to the laboratory with the collected samples.

One blind field duplicate sample will be collected using a duplicate sampling "T" connector from one well.

The trip blank and field duplicate will be analyzed for the sample parameters as the field samples.

Leak detection compound will be used during sampling.

Chain-of-Custody protocols will be followed including the use of custody seals.

Sorbent samples will be delivered to the lab by overnight courier stored on ice in coolers.

2.6.2 Lab QA/QC

A comparison of the chain-of-custody to the laboratory login will be made to confirm samples were received in good condition and the appropriate analysis methods are scheduled. The holding time for TO-17 analysis is 30 days.

The results of lab blanks, lab surrogates, and lab duplicates will be compared to method requirements and discrepancies will be identified and discussed. Any lab dilutions will be noted and the reasons for the dilutions discussed. Internal standard responses and retention times will be compared to method limits for all field samples and quality control samples. The initial and all continuing calibration verification standards will be compared to method limits for all samples and quality control samples. The Air Toxics report will include a narrative and various laboratory flags, if necessary. Based on review of the narrative, a determination will be made regarding the usability of the results.

3.0 GEOTECHNICAL PARAMETER SAMPLES

3.1 Collection of Geotechnical Parameter Samples

The geotechnical samples will be obtained from each soil boring location and the sample intervals adjusted accordingly to obtain the vadose zone soil type from above the water table.

One undisturbed soil sample will be collected using Shelby™ tube or macro tube from each soil boring location. The undisturbed samples will be sealed on both ends of the tube and delivered to the laboratory using care to not disturb the samples.

3.2 Analysis of Geotechnical Parameter Samples

The geotechnical samples will be analyzed by a geotechnical testing laboratory with appropriate certifications and licenses for the following geotechnical parameters:

- Dry Bulk Density: An accurate measurement of dry bulk density requires determination of the dry weight and volume of an undisturbed sample. An

undisturbed soil core sample may be collected using a Shelby™ tube (a thin-walled sampler) or an equivalent method, sealing both ends of the tube, and taking care in the transport to the laboratory. The sample must not be disturbed prior to laboratory analysis. Dry bulk density is estimated using the ASTM Method D2937, "*Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method.*"

- Volumetric Water Content/Moisture Content: The ASTM Method D2216, "*Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soils and Rock by Mass*" may be used to calculate moisture content.

- Specific Gravity: Samples may be analyzed using ASTM D854, *"Standard Test Methods for Specific Gravity of Soil Solids by Water Pycnometer."*

- Porosity is estimated using specific gravity and soil dry bulk density; therefore, no additional field measurements are necessary.

4.0 REFERENCES

RAM Group, 2004. Risk-Based Corrective Action Report, Boeing Tract 1, St. Louis, Missouri.

MDNR, April 2006. Departmental Missouri Risk-Based Corrective Action Technical Guidance.

Table 1
Analytical Results of Soil Samples Collected in 2006
Boeing Tract 1, St. Louis, Missouri

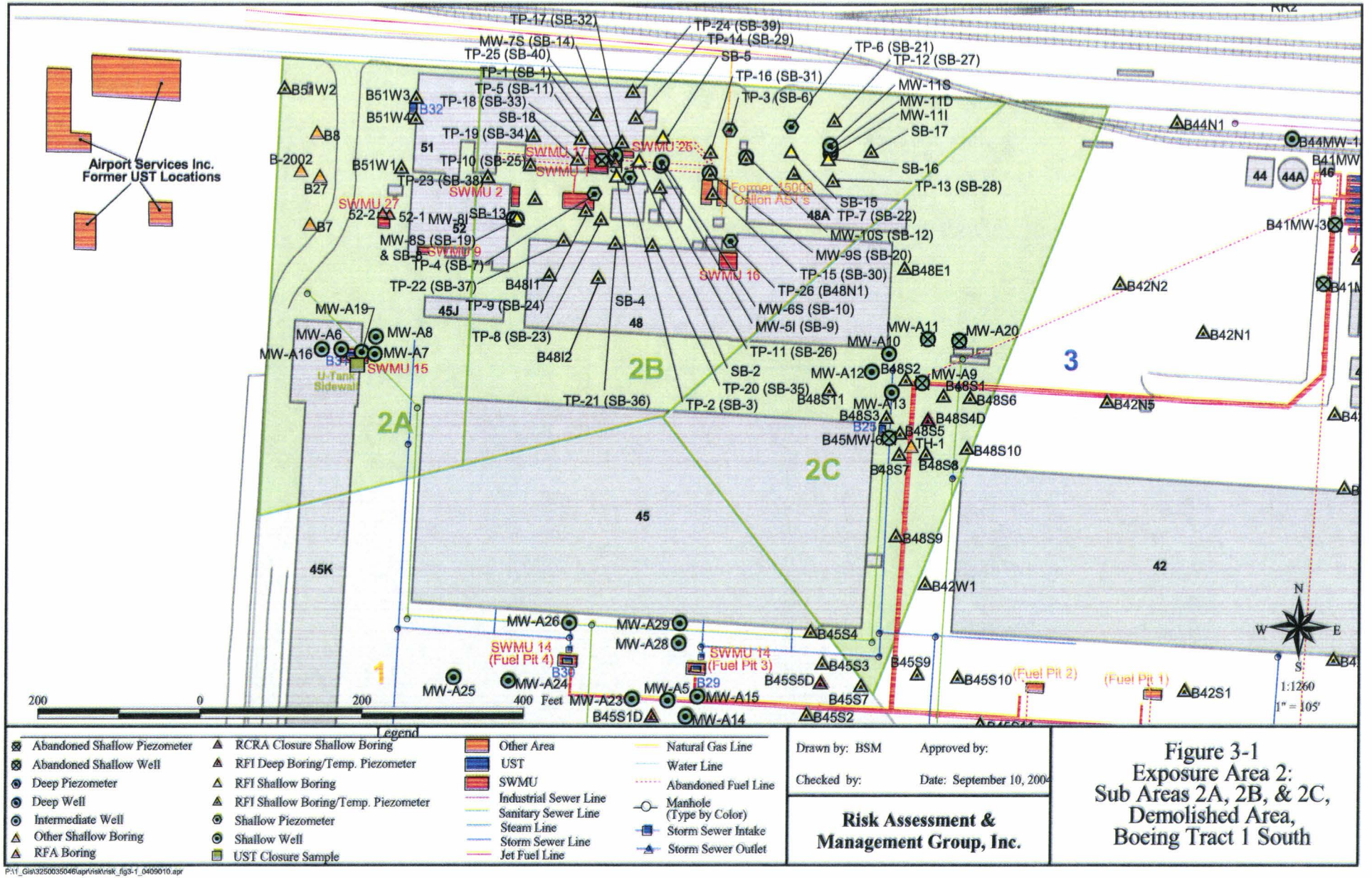
Sample ID	Tier 1 RBTL for Indoor Inhalation, Non-residential	B27E2 V1	B27E2 V1	B27E2 V2	B27E2 V2	B27I9 V1	B27I9 V1	B27I9 V2	B27I9 V2	TP-15 V1	TP-9 V1
Sample Depth (ft bgs)		4	7	4	7	4	8	4	8	5	4
Date		2/20/2006	2/20/2006	2/20/2006	2/20/2006	2/20/2006	2/20/2006	2/20/2006	2/20/2006	2/23/2006	2/23/2006
Benzene	1.98E+00	**0.0058**	<0.0013	<0.0012	<0.0012	<0.0012	<0.0063	<0.0062	<0.0013	<0.0013	<0.0065
Toluene	4.01E+03	<0.0064	<0.0063	<0.0063	<0.0063	<0.0063	<0.032	<0.031	<0.0064	<0.0063	<0.033
Ethylbenzene	5.77E+04	<0.0013	<0.0013	<0.0012	<0.0012	<0.0012	<0.0063	<0.0062	<0.0013	<0.0013	<0.0065
Xylenes	1.99E+02	<0.0038	<0.0038	<0.0038	<0.0038	<0.0038	<0.019	<0.018	<0.0038	<0.0038	<0.02
MTBE	1.13E+02	<0.0013	<0.0013	<0.0012	<0.0012	<0.0012	<0.0063	<0.0062	<0.0013	<0.0013	<0.0065
TPH-GRO	3.10E+03	<0.64	<0.63	<0.63	<0.63	<0.63	<3.2	<3.1	<0.64	**1.5**	<3.3
TPH-DRO	3.34E+04	<13	<13	<12	<12	<12	**1900**	**20**	**54**	**190**	<13
TPH-ORO	NA	<13	<13	<12	<12	<12	**6300**	**130**	**240**	**26**	<13

Notes:
All concentrations in milligrams per kilogram (mg/kg)
ft bgs: Feet below ground surface
Value in bold: Detected

Table 1
Analytical Results of Soil Samples Collected in 2006
Boeing Tract 1, St. Louis, Missouri

Sample ID	Tier 1 RBTL for Indoor Inhalation, Non-residential	TP-16 V1	TP-7 V1	TP-7 V1	B45S8 V1	B42W1 V1	B2S2 V1	B2S2 V2	B45S11 V1	B42S5 V1
Sample Depth (ft bgs)		4	4	5	3	3	3	3	3	3
Date		2/23/2006	2/23/2006	2/23/2006	2/23/2006	2/23/2006	2/23/2006	2/23/2006	2/23/2006	2/23/2006
Benzene	1.98E+00	<0.047	<0.0013	<0.049	<0.0012	<0.0013	**0.099**	**0.0091**	<0.11	<0.052
Toluene	4.01E+03	<0.23	<0.0063	<0.24	<0.0062	<0.0065	**0.0082**	<0.0064	<0.53	<0.26
Ethylbenzene	5.77E+04	<0.047	<0.0013	<0.049	<0.0012	<0.0013	**0.052**	<0.0013	<0.11	<0.052
Xylenes	1.99E+02	<0.14	<0.0038	<0.15	<0.0037	<0.0039	**0.04**	<0.0038	<0.32	<0.16
MTBE	1.13E+02	<0.047	<0.0013	<0.049	<0.0012	<0.0013	<0.0012	**0.0068**	<0.11	<0.052
TPH-GRO	3.10E+03	**52**	**0.96**	**85**	<0.62	<0.65	**7**	**0.8**	**61**	**35**
TPH-DRO	3.34E+04	**1800**	**290**	**4000**	<12	**14**	<12	**13**	**13**	**14**
TPH-ORO	NA	**69**	**25**	**130**	<12	<13	<12	<13	<13	<13

Notes:
All concentrations in milligrams per kilogram (mg/kg)
ft bgs: Feet below ground surface
Value in bold: Detected



Drawn by: BSM Approved by:

Checked by: Date: September 10, 2004

Risk Assessment & Management Group, Inc.

Figure 3-1
Exposure Area 2: Sub Areas 2A, 2B, & 2C, Demolished Area, Boeing Tract 1 South

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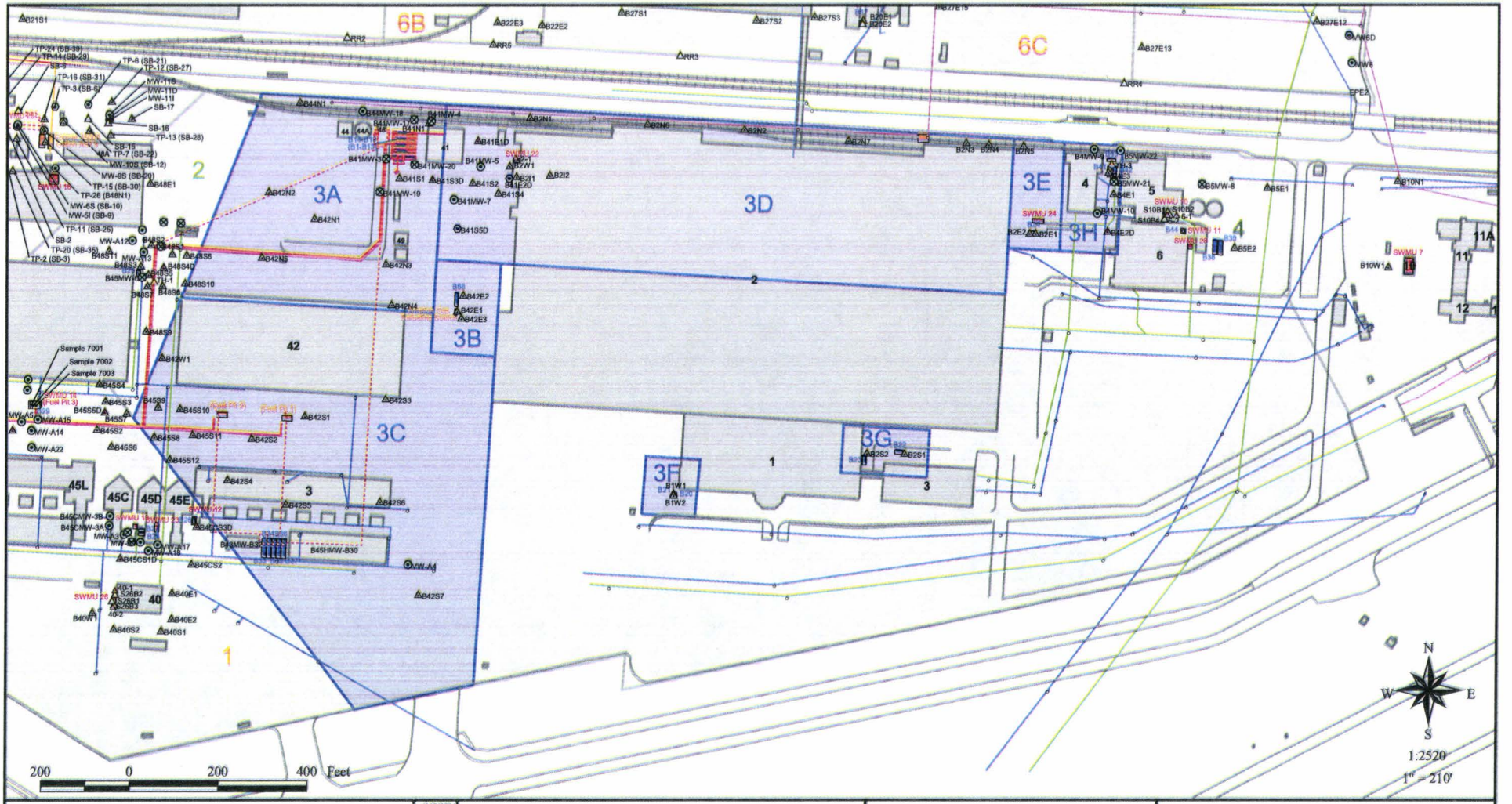

Drawn by: BSM Approved by:

Checked by: Date: September 10, 2003

Risk Assessment & Management Group, Inc.

Figure 4-1
Exposure Area 3:
Sub Areas: 3A, 3B, 3C, 3D, 3E, 3F, 3G, & 3H
Retained Area,
Boeing Tract 1 South

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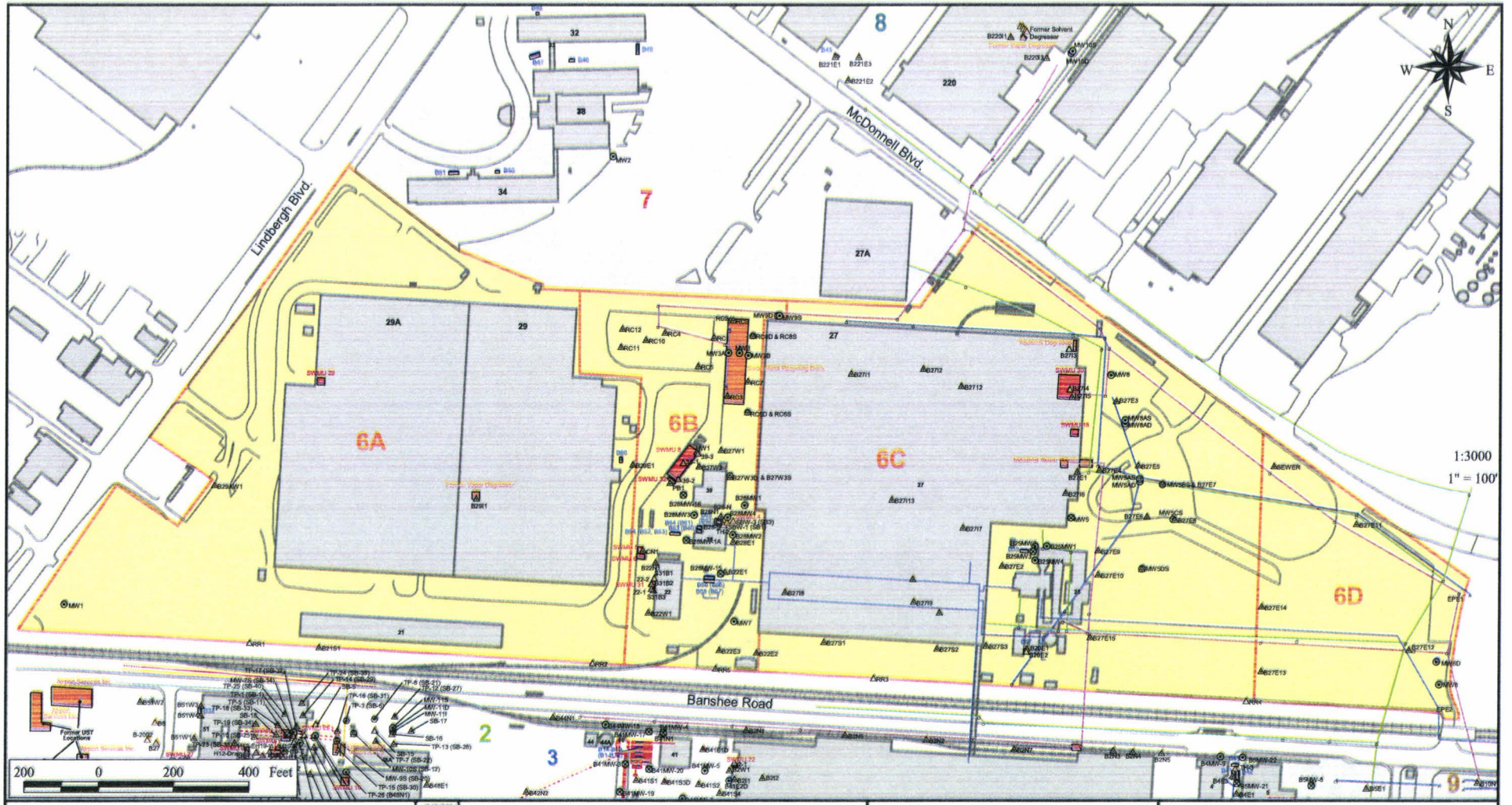

Drawn by: BSM Approved by:

Checked by: Date: September 13, 2004

Risk Assessement & Management Group, Inc.

Figure 7-1
Exposure Area 6:
Sub Areas: 6A, 6B, 6C, 6D
GKN Facility,
Boeing Tract 1 North

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Appendix C
Proposed AUL Language

ENVIRONMENTAL COVENANT

This Environmental Covenant is entered into by and between The City of St. Louis, a municipal corporation of the State of Missouri ("Owner"), and McDonnell Douglas Corporation, a wholly-owned subsidiary of The Boeing Company, and The Boeing Company ("Holders"), pursuant to the Missouri Environmental Covenants Act, Sections 260.1000 through 260.1039, RSMo.

RECITALS

WHEREAS, Owner, whose mailing address is _____, is the owner in fee simple of certain real property commonly known and numbered as _____, and legally described as: **[insert "legal description of the real property"]** the "Property;"

WHEREAS, Owner desires to grant to the Holders, whose mailing address is 100 North Riverside Plaza, Chicago, Illinois 60606-1596, this Environmental Covenant for the purpose of subjecting the Property to certain activity and use limitations as provided in the Missouri Environmental Covenants Act;

WHEREAS, the Property is the subject of RCRA Corrective Action pursuant to the requirements of Hazardous Waste Permit No. OSO 62284002, issued by the Missouri Department of Natural Resources (the "Permit"); and

WHEREAS, the Permit required environmental investigation of the Property, which investigation revealed the presence of groundwater and soil contamination at various portions of the Property; the results of which are documented in a Remedial Facility Investigation Report, dated _____; and

WHEREAS, the Permit required preparation of a Corrective Measures Study, which evaluated and proposed various remedial and other measures to remove, contain and otherwise address environmental contamination documented by the Remedial Facility Investigation Report; and

WHEREAS, in support of the Corrective Measures Study, a risk assessment was performed to determine the clean-up levels for the contamination identified in the Remedial Facility Investigation Report consistent with the Property's current and anticipated future use as an airport related maintenance and manufacturing facility; the results of which are documented in a Risk-Based Corrective Action Report, dated _____; and

WHEREAS, the Missouri Department of Natural Resources has reviewed and approved the Remedial Facility Investigation Report, the Corrective Measures Study, and the Risk-Based Corrective Action Report and has determined that this Environmental Covenant will support completion of the RCRA Corrective Action requirements of the

Permit by limiting future use of the property consistent with the assumptions underlying the Risk-Based Corrective Action Report and the Corrective Measures Study; and

WHEREAS, The term "Department" shall have the meaning given it in Section 260.1003(2) RSMo.

NOW THEREFORE, Owner, Holders, and the Department agree to the following:

1. Parties.
The Owner, the Holder and the Department are parties to this Environmental Covenant and may enforce it as provided for in Section 260.1030, RSMo.

2. Activity and Use Limitations.
As part of the implementation of institutional controls to support completion of the corrective actions required by the Permit, Owner hereby subjects the Property to, and agrees to comply with, the following activity and use limitations:

A. Restriction on Residential Use of the Property: The Property shall not be used, and the Owner shall not permit use of the Property, for single-family dwellings which individual residents may inhabit for 350 days or more per year for a cumulative period of 24 hours or more, or in the case of a child resident, for 350 days or more per year for a cumulative period of 6 years or more. If any Owner desires in the future to use the Property for a prohibited residential purpose, the Owner shall notify the Department 120 days in advance of such use and obtain Department approval for such use subject to conducting any further analyses and, as necessary, response action(s) as the Department may require as a condition of its approval. The Property may not be used in a manner that conflicts with this restriction.

B. Restriction on Use of Groundwater: The Owner of the Property shall not install or maintain, and shall not permit the installation and maintenance of, groundwater extraction wells on the Property for use as a drinking water supply or for other domestic purposes which may result in human ingestion of the groundwater or dermal exposure to the groundwater. This restriction shall not preclude installation and maintenance of groundwater wells on the Property for purposes of investigating, characterizing, or monitoring the groundwater. If any Owner desires in the future to use the groundwater for a prohibited purpose, the Owner shall notify the Department 120 days in advance of such use and obtain Department approval for such use subject to conducting any further analyses and, as necessary, response action(s) as the Department may require as a condition of its approval. The Property may not be used in a manner that conflicts with this restriction.

C. Restriction on Agricultural Use of the Property. The Property shall not be used, and the Owner shall not permit use of the Property, for agricultural or other uses which may result in routine dermal contact by individual non-residential

workers with surficial soils (defined as soils located zero to three feet below the ground surface) for 250 days or more for a cumulative period of 25 years or more. This restriction shall not preclude construction work on the Property notwithstanding that construction workers may have routine dermal contact with surficial soils, nor does this restriction preclude work involving grounds maintenance, installation and maintenance of landscaping and ornamental gardens, and/or installation and maintenance of irrigation systems associated with the foregoing. If any Owner desires in the future to use the Property for a prohibited agricultural purpose, the Owner shall notify the Department 120 days in advance of such use and obtain Department approval for such use subject to conducting any further analyses and, as necessary, response action(s) as the Department may require as a condition of its approval. The Property may not be used in a manner that conflicts with this restriction.

3. Running with the Land.
This Environmental Covenant shall be binding upon Owner and its successors, assigns, and Transferees in interest, and shall run with the land, as provided in Section 260.1012, RSMo, subject to amendment or termination as set forth herein. The term "Transferee," as used in this Environmental Covenant, shall mean any future owner of any interest in the Property or any portion thereof, including, but not limited to, owners of an interest in fee simple, mortgagees, easement holders, and/or lessees.

4. Location of Administrative Record for the Environmental Response Project.
The administrative record for the environmental response project for the Property is located at [TBD].

5. Enforcement.
Compliance with this Environmental Covenant may be enforced as provided in Section 260.1030, RSMo. Failure to timely enforce compliance with this Environmental Covenant or the activity and use limitations contained herein by any party shall not bar subsequent enforcement by such party and shall not be deemed a waiver of the party's right to take action to enforce any non-compliance. Nothing in this Environmental Covenant shall restrict any person from exercising any authority under any other applicable law.

6. Right of Access.
Owner hereby grants to each of the Holders, the Department and their respective agents, contractors, and employees, the right of access at all reasonable times to the Property for implementation, monitoring or enforcement of this Environmental Covenant. Nothing herein shall be deemed to limit or otherwise affect the Department's rights of access and entry under federal or state law.

~~**7. (May be optional depending on the Site.) Compliance Reporting.**~~
~~Owner/Transferee shall submit to the Holder and the Department, by no later than January 31st of each year, documentation verifying that the activity and use limitations imposed hereby were in place and complied with during the preceding calendar year.~~

~~Such reports shall be sent to the Holder and the Department at the address that appears in paragraph 18 (Notice) below. The Holder and the Department may change their/its mailing address by written notice to Owner/Transferee. The Compliance Report shall include the following statement, signed by Owner/Transferee: To the best of my knowledge, after thorough investigation, I certify that the information contained in or accompanying this submission is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.~~ [PROPOSE TO DELETE THIS REQUIREMENT AS UNECCESSARY GIVEN THE USE LIMITATIONS]

8. Additional Rights.
None.

9. Notice upon Conveyance.
Each instrument hereafter conveying any interest in the Property or any portion of the Property shall contain a notice of the activity and use limitations set forth in this Environmental Covenant, and provide the recording reference for this Environmental Covenant. The notice shall be substantially in the following form: THE INTEREST CONVEYED HEREBY IS SUBJECT TO AN ENVIRONMENTAL COVENANT, DATED _____,20__, RECORDED IN THE OFFICE OF THE RECORDER OF DEEDS OF _____ COUNTY, _____, ON _____, 20__, AS DOCUMENT ____, BOOK___, PAGE ____. Owner/Transferee shall notify the Holder and the Department within ten (10) days following each conveyance of an interest in any portion of the Property. The notice shall include the name, address, and telephone number of the Transferee, and a copy of the deed or other documentation evidencing the conveyance.

10. Notification Requirement.
Owner shall notify the Department following transfer of any interest in the Property or of any changes in use of the Property inconsistent with the Activity and Use Limitations specified in paragraph 2 above.

11. Representations and Warranties.
Owner hereby represents and warrants to the Holders and the Department that Owner has the power and authority to enter into this Environmental Covenant, to grant the rights and interests herein provided and to carry out all of Owner's obligations hereunder; that Owner is the sole owner of the Property and holds fee simple title, which is free, clear and unencumbered; to the extent that other interests in the Property exist, Owner has agreed to subordinate such interest to this Environmental Covenant, pursuant to Section 260.1006.4, RSMo, and the subordination agreement (attached hereto as Exhibit __ or recorded at _____); that Owner has identified all other parties who hold any interest (e.g., encumbrance) in the Property and notified such parties of Owner's intention to enter into this Environmental Covenant; and that this Environmental Covenant will not materially violate or contravene or constitute a material default under any other agreement, document or instrument to which Owner is a party or by which Owner may be bound or affected.

12. Amendment or Termination.
This Environmental Covenant may be amended or terminated by consent signed by the Department and the Holders. Signatories to this Environmental Covenant other than Department and the Holders hereby waive the right to consent to any amendment to, or termination of, this Environmental Covenant. Within thirty (30) days of signature by all requisite parties on any amendment or termination of this Environmental Covenant, Owner/Transferee shall file such instrument for recording with the office of the recorder of the county in which the Property is situated, and within thirty (30) days of the date of such recording, Owner/Transferee shall provide a file- and date-stamped copy of the recorded instrument to the Department and the Holder.

13. Severability.
If any provision of this Environmental Covenant is found to be unenforceable in any respect, the validity, legality, and enforceability of the remaining provisions shall not in any way be affected or impaired.

14. Governing Law.
This Environmental Covenant shall be governed by and interpreted in accordance with the laws of the State of Missouri.

15. Recordation.
Within thirty (30) days after the date of the final required signature upon this Environmental Covenant, Owner shall record this Environmental Covenant with the office of the recorder of the county in which the Property is situated.

16. Effective Date.
The effective date of this Environmental Covenant shall be the date upon which the fully executed Environmental Covenant has been recorded with the office of the recorder of the county in which the Property is situated.

17. Distribution of Environmental Covenant.
Within thirty (30) days following the recording of this Environmental Covenant, or any amendment or termination of this Environmental Covenant, Owner/Transferee shall, in accordance with Section 260.1018, RSMo, distribute a file- and date-stamped copy of the recorded Environmental Covenant to: (a) each signatory hereto; (b) each person holding a recorded interest in the Property; (c) each person in possession of the Property; (d) each municipality or other unit of local government in which the Property is located; and (e) any other person designated by the Department.

18. Notice.
Any document or other item required by this Environmental Covenant to be given to another party hereto shall be sent to:

If to Owner:
[name]
[address]

If to Holder:
[name]
[address]

If to Department:
[name]
[address]

The undersigned represent and certify that they are authorized to execute this Environmental Covenant.

IT IS SO AGREED:

FOR OWNER

By: _____ Date: _____
Name (print):
Title:
Address:
[Consult Section 442.210, RSMo for acknowledgement requirements.]
STATE OF _____)
)
COUNTY OF _____)
On this ___ day of _____, 20__, before me, a Notary Public in and for said state, personally appeared (Name), (Title) of _____(Corporate Name), known to me to be the person who executed the within Environmental Covenant on behalf of said corporation and acknowledged to me that he/she executed the same for the purposes therein stated.

_____
Notary Public

FOR HOLDERS
By: _____ Date: _____
Name (print):
Title:
Address:
STATE OF _____)
)
COUNTY OF _____)
On this ___ day of _____, 20__, before me, a Notary Public in and for said state, personally appeared (Name), (Title) of _____(Corporate Name),

known to me to be the person who executed the within Environmental Covenant in behalf of said corporation and acknowledged to me that he/she executed the same for the purposes therein stated.

_____
Notary Public

FOR DEPARTMENT
By: _____ Date: _____
Name (print):
Title:
Address:
STATE OF _____)
)
COUNTY OF _____)
On this ___ day of _____, 20__, before me, a Notary Public in and for said state, personally appeared (Name), (Title) of _____(Corporate Name), known to me to be the person who executed the within Environmental Covenant in behalf of said corporation and acknowledged to me that he/she executed the same for the purposes therein stated.

_____
Notary Public

To: Christine Kump-Mitchell, P.E. (MDNR)

From: Joe Haake

CC: Atul Salhotra Ph.D. (RAM Group)

Date: December 15, 2009

Re: Possible Remedial Alternatives for Evaluation, Boeing Tract 1

As per our conversation on December 10, 2009 with Atul Salhotra of the RAM Group, this memo is an addendum to the November 30, 2009 Corrective Measure Study (CMS) Work Plan. As requested, this addendum addresses potential remedial alternatives that may be evaluated during the CMS.

As a part of the CMS, the following activities will be performed:

1. Soil Vapor Sampling
2. Groundwater Sampling to evaluate Plume Stability and Monitored Natural Attenuation (MNA)
3. Establishment of Institutional Controls including:
    - Land use restrictions,
    - Groundwater use restrictions, and
    - Use of personal protective equipment (PPE) for construction worker.
4. Remedial Alternatives Evaluation and Selection, as necessary.

Once the above activities are completed, detailed explanation of each of the remedial technologies to be considered at the site will be included in the CMS Report. The CMS Report will also include rationale for eliminating remedial technologies initially considered but dropped form further consideration.

A. Remedial Options to Address Vapor Risk

The risk exceedences are primarily due to vapor inhalation (refer to Table1); hence, subsequent to the collection and evaluation of soil vapor samples, if risks are still unacceptable, then remedial alternatives will be considered. Feasible remedial alternatives will be identified and evaluated on an area-specific basis to determine the recommended remedial alternative(s).

The following remedial options may be considered:

- In-situ bioremediation (for low molecular weight organics)
- Air sparging with soil vapor extraction (SVE)
- Chemical oxidation
- Precipitation/Co-precipitation (for mercury only)
- Ion Exchange (for mercury only)
- Monitored natural attenuation (MNA)

- Pump and treat
- Mobile enhanced multiphase extraction (for Sub-areas 2B and 2C with trace light non-aqueous phase liquid (LNAPL) present)

B. Remedial Options to Address Plume Stability (LNAPL)

In addition, if the groundwater plume is not stable due to the presence of trace LNAPL, the following remedial options will be considered:

- Mobile enhanced multi-phase extraction
- Passive free product recovery

This applies only to Area 1 and Sub-areas 2B and 2C.

C. Remedial Options to Address Plume Stability (non-LNAPL sources)

If groundwater concentrations are not stable due to reasons other than LNAPL, then the remedial alternatives in Section A will be considered. Note this applies to the entire site.

D. Overall Summary

Table 1 presents the Area / Sub-areas which exceed risk including the chemicals, receptors, and exposure pathways. The last column indicates the remedial alternatives that may be evaluated during the CMS.

The above listed alternatives will be evaluated using a two-step approach. First, each technology must meet all of the following criteria:

- Protection of health and environment,
- Ability to achieve cleanup objectives,
- Reduction/Elimination of further releases, and
- Compliance with waste management standards.

Second, the technologies that meet the above criteria will be further evaluated and selected for recommendation based on the following:

- Reduction of toxicity, mobility, and volume,
- Implementability,
- Short-term effectiveness,
- Long-term reliability and effectiveness, and
- Cost.

If you have any questions, please contact me at 314-777-9181 or Atul Salhotra / Kendall Pickett at 713-784-5151.

Attachment: Table 1

Primary Chemicals and Routes of Exposure that Caused Risk and Hazard Exceedences and Their Possible Remedial Technologies
Boeing Tract 1, Hazelwood, Missouri

Area	COC	Exceedence Due to	Possible Remedial Technology
Sub-Area 1	Trace LNAPL	No Exceedences	Mobile Enhanced Multiphase Extraction Passive Free Product Recovery
Sub-area 2A	TPH-GRO	Indoor inhalation from GW by non-residential worker	In-Situ Bioremediation (for low MW organics) Air Sparging with SVE Chemical Oxidation Monitored Natural Attenuation Pump and Treat
	TPH-DRO	Indoor inhalation from GW by non-residential worker	
Sub-area 2B	Trace LNAPL	No Exceedences	Mobile Enhanced Multiphase Extraction Passive Free Product Recovery
	Aliphatics >nC12 to nC16	Indoor inhalation from GW by non-residential worker	In-Situ Bioremediation (for low MW organics) Air Sparging with SVE Chemical Oxidation Monitored Natural Attenuation Pump and Treat
	Aliphatics >nC16 to nC21	Indoor inhalation from GW by non-residential worker	
	Aliphatics >nC21 to nC35	Indoor inhalation from GW by non-residential worker	
	Tetrachloroethene	Dermal contact with GW by future construction worker	Personal Protective Equipment (PPE) under HASP
Sub-area 2C	Trace LNAPL	No Exceedences	Mobile Enhanced Multiphase Extraction Passive Free Product Recovery
	Benzene	Outdoor inhalation of vapors from GW by future construction worker	In-Situ Bioremediation (for low MW organics) Air Sparging with SVE Chemical Oxidation Monitored Natural Attenuation Pump and Treat
	TPH-GRO Aliphatics >nC5 to nC8	Outdoor inhalation of vapors from GW by outdoor worker and future construction worker	
	TPH-GRO Aliphatics >nC9 to nC18	Outdoor inhalation of vapors from GW by outdoor worker and future construction worker	
	TPH-GRO Aromatics >nC9 to nC18	Outdoor inhalation of vapors from GW by future construction worker	
Sub-area 3A	TPH-DRO	Indoor inhalation from GW by non-residential worker	Air Sparging with SVE Chemical Oxidation Monitored Natural Attenuation Pump and Treat
Sub-area 3C	TPH-DRO	Indoor inhalation from GW by non-residential worker	
	TPH-ORO	Indoor inhalation from GW by non-residential worker	
	Total TPH	Outdoor inhalation of vapors from GW by construction worker	
Sub-area 3E	Aliphatics >nC16 to nC21	Indoor inhalation from GW by non-residential worker	
Sub-area 3G	Aliphatics >nC21 to nC35	Indoor inhalation from GW by non-residential worker	
Sub-area 3H	Mercury	Outdoor inhalation of vapors from GW by future construction worker	Precipitation/Co-precipitation Ion Exchange Resins Monitored Natural Attenuation Pump and Treat
	TPH-DRO Aliphatics >nC9 to nC18	Outdoor inhalation of vapors from GW by future construction worker	In-Situ Bioremediation (for low MW organics) Air Sparging with SVE Chemical Oxidation Monitored Natural Attenuation Pump and Treat
	TPH-DRO Aromatics >nC9 to nC18	Outdoor inhalation of vapors from GW by future construction worker	

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Primary Chemicals and Routes of Exposure that Caused Risk and Hazard Exceedences and Their Possible Remedial Technologies
Boeing Tract 1, Hazelwood, Missouri

Area	COC	Exceedence Due to	Possible Remedial Technology
Sub-area 6B	Aroclor 1254	Dermal contact with GW by future construction worker	PPE under HASP
	Benzo(a)anthracene	Dermal contact with GW by construction worker	
	1,2-dichloroethene (total)	Outdoor inhalation of vapors from GW by future construction worker	Chemical Oxidation Monitored Natural Attenuation Pump and Treat
	Trichloroethene	Outdoor inhalation of vapors from GW and dermal contact with GW by future construction worker	
	Vinyl chloride	Outdoor inhalation of vapors from GW by future construction worker	
	Mercury	Outdoor inhalation of vapors from GW by future construction worker	Precipitation/Co-precipitation Ion Exchange Resins Monitored Natural Attenuation Pump and Treat
	Aliphatics >nC16 to nC21	Indoor inhalation from GW by non-residential worker	In-Situ Bioremediation (for low MW organics) Air Sparging with SVE Chemical Oxidation Monitored Natural Attenuation Pump and Treat
	Benzene	Outdoor inhalation of vapors from GW by future construction worker	
	TPH-GRO Aliphatics >nC5 to nC8	Outdoor inhalation of vapors from GW by future construction worker	
	TPH-GRO Aliphatics >nC9 to nC18	Outdoor inhalation of vapors from GW by future construction worker	
	TPH-GRO Aromatics >nC9 to nC18	Outdoor inhalation of vapors from GW by future construction worker	
	TPH-DRO Aliphatics >nC9 to nC18	Outdoor inhalation of vapors from GW by outdoor worker and future construction worker	
	TPH-DRO Aromatics >nC9 to nC18	Outdoor inhalation of vapors from GW by future construction worker	
Sub-area 6C	Aliphatics >nC16 to nC21	Indoor inhalation from GW by non-residential worker	
	Aliphatics >nC21 to nC35	Indoor inhalation from GW by non-residential worker	
Sub-area 8B	Aliphatics >nC16 to nC21	Indoor inhalation from GW by non-residential worker	
	Aliphatics >nC21 to nC35	Indoor inhalation from GW by non-residential worker	

Notes:
TPH - Total Petroleum Hydrocarbons
ORO - Oil Range Organics
SVE: Soil Vapor Extraction
HASP - Health and Safety Plan
GRO - Gasoline Range Organics
C - Carbon Range
MW - Molecular Weight
PPE - Personal Protective Equipment
DRO - Diesel Range Organics
GW - Groundwater
LNAPL - Light Non-Aqueous Phase Liquid